

ABSTRACT

An apparatus and method for an efficient, passively Q-switched microlaser producing high peak power pulses of light of extremely short duration are disclosed. This microlaser utilizes Yb³⁺:YAG as the gain medium instead of conventionally used Nd³⁺:YAG or Nd³⁺:YVO₄ gain media. The utilization of the Yb³⁺:YAG allows superior performance of high peak-power microlaser in many aspects with respect to conventionally used Nd³⁺:YAG as the gain media. The efficiency of the pump of said microlaser (the so called optical-to-optical efficiency) can be higher by factor of two to four, with respect to Nd:YAG based, provided all other output parameters such as pulselwidth, output peak power and spatial quality of the beam being equal. The improved efficiency allows reducing the cost and size of the whole microlaser system substantially. In addition to lowering the cost of the microlaser system by factor of two to three, the temperature stability of the proposed microchip laser improved by factor of 5, due to the wider absorption bandwidth of the Yb³⁺:YAG to those of Nd³⁺: YAG or Nd³⁺:YVO₄.

References Cited

U.S. Patent Documents

1. US Patent # 5,394,413. Zaykowski, J. J. (1995). Passively Q-switched Picosecond Microlaser. .
2. US Patent #5,495,494. Molva, E., Aubert, J. J., Marty, J., & J.M., N. (1994). Self-aligned, monolithic, solid microlaser with passive switching by a saturable absorber and a production process therefor.
3. US Patent # 5844932. Thony, P., & Rabarot, M. (1998). Microlaser cavity and externally controlled, passive switching, solid pulsed microlaser.

Other Publications

1. Zaykowski, J.J., Dill III, C., Cook, C. & Daneu, J.L. *Mid and High Power Passively Q-Switched Microchip Lasers*. 1-268-70 (Optical Society of America, Washington DC, 1999).
2. Spuhler, G.J., *et al. Design guidelines for passively Q-switched microchip lasers using semiconductor saturable absorber mirrors* 1-274-6 (Optical Society of America, Washington DC, 1999).
3. Giesen, A., *et al. Scalable concept for diode-pumped high-power solid-state lasers* *Applied Physics B* 365-72 (1994).
4. Karszewski, M., *et al. 100 W TEM00 Operation of Yb:YAG Thin Disc Laser with High Efficiency* 1-296-9 (1998).
5. DeLoach, L.D., *et al. Evaluation of absorption and emission properties of Yb³⁺ doped crystals for laser applications* *IEEE Journal of Quantum Electronics* **29**, 1179-91 (1993).

6. Bibeau, C., et al. *Performance and scalability of diode-end-pumped Yb:YAG laser* 1-328 (IEEE Lasers and Electro-Optics Society, San Francisco, CA, USA. 10-13 Nov. 1997., 1997).
7. Spuhler, G.J., et al. *Passively Q-switched Yb:YAG microchip laser using a semiconductor saturable absorber mirror* 1-271-2 (Optical Society of America, Washington DC, 1999).
8. Zaykowski, J.J. & Kelley, P.L. Optimization of Q-switched lasers *IEEE Journal of Quantum Electronics* **27**, 2220-5 (1991).